§14. Performance Improvement of LABCOM Date Acquisition and Storage System

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The data acquisition and storage management system for LHD plasma diagnostics, which is named as *LABCOM system*, has been improved for its performance and system stability during the third LHD experimental campaign in 1999. As the installations of the diagnostic equipment had been smoothly progressed in this period, both the number of the measurement devices and the total data volume acquired by the LABCOM system has been increased almost as twice as the previous period.

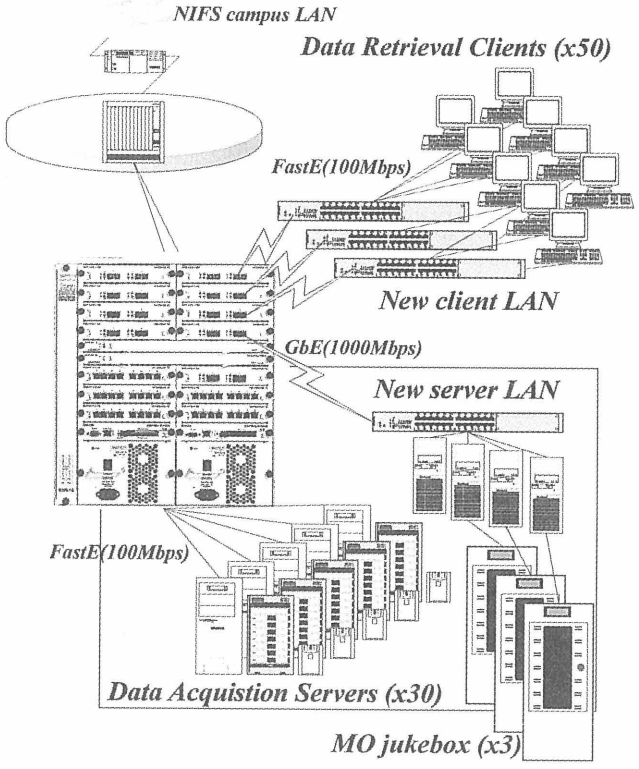

Fig.1. New network structure of the data acquisition and storage domain.

New Layer-4 Network Switching Fabric

In the later half of the LHD 2nd experimental period, the network bottleneck in retrieving the diagnostic data had gradually become worse because of the growth of the acquired and thus referred data amount. As the main cause of this network bottleneck was the slowness of the conventional FDDI-based router that manages the network streams on software processing, i.e. by the cpu calculations. Their typical routing performance was about a few kpps. In order to improve the network performance thoroughly, the newest layer-4 switching fabric ``Cabletron SSR-8600" has been installed for the replacement of the conventional Fujitsu LR-450 router, and a few sets of ``Cabletron ELS100-24TXG" layer-2 switch replaced the OMNI-9 layer-2 switching hubs. SSR-8660 has the networking capability of 32 Gbps switching streams and 30 Mpps routing throughputs, and ELS100-24TXG has 4.2 Gbps and 5.5 Mpps, respectively. Their performance seems enough adequate for the prospective data growth that gains almost double year by year.

Performance Improvement of CAMAC Data Transfer and Database Storage

For controlling the CAMAC crate controller (CC) and various digitizers through the SCSI optical extender, we already developed and applied the homemade CAMAC handling software on 30 Windows NT data acquisition servers. The typical throughput of the block data transfer is about 700kB/s between KineticSystems 3929Z1B CC and Jorway Aurora14 ADC. In addition to the 3929Z1B, we have also succeeded to cope with the new Jorway 73A SCSI CC whose transferring performance goes up to 1 MB/s. The source code optimization applying the multi-thread programming has also improved the total online processing rate of data acquisition and database storage up to 480 kB/s from previous 380 kB/s. This attainment almost reached the best 400~500 kB/s O2 database writing rate that was ever examined on PentiumPro 200 MHz dual-cpu machine. The code reform also brought about the improvement of the whole system's reliability. Especially in the latter half of the 3rd experimental period, the achieved operational reliability rate of the LABCOM online system was kept over 99 %.

Mass Storage Operation

The LABCOM system has been operating the 2 levels of the storage hierarchy: One is the 50 GB local RAID for each server computer of 30 diagnostics, and the other is the 3 MO jukebox whose total size is 3.6 TB. At the end of the 3rd cycle, the total volume of the LABCOM archived rawdata has come up to 2 TB in MO jukeboxes, with maximum 280 MB rawdata production by every shot. The sum total with some standalone measurements can be estimated as about 400 MB/shot data production rate. In is easily predictable that in the coming new experimental period, the total shot data will certainly reach the original design specification of about 600 MB or 1 GB per each shot.

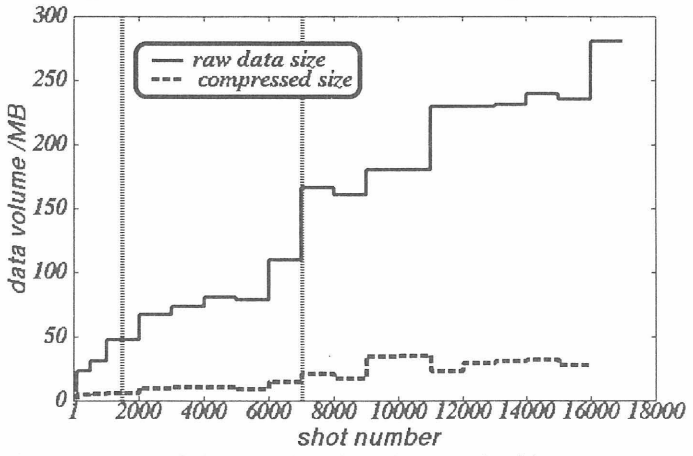

Fig.2. Growth of shot-by-shot data size acquired by LABCOM system: At every end of the experienced three experimental campaigns, the rawdata size had been kept growing almost as double as the previous one